(12) UK Patent Application (19) GB (11) 2 171 267 A

(43) Application published 20 Aug 1986

(21) Application No 8603679

(22) Date of filing 14 Feb 1986

(30) Priority data

(31) 8503971 (32) 15 Feb 1985 (33) GB

(71) Applicant
The General Electric Company Plc (United Kingdom), 1 Stanhope Gate, London W1A 1EH

(72) Inventor
Christopher John Allum

(74) Agent and/or Address for Service
W. P. Keppler, The General Electric Company Plc, Central Patent Department (Wembley Office), Hirst Research Centre, Wembley, Middlesex HA9 7PP

(51) INT CL⁴
B23K 9/09

(52) Domestic classification (Edition H):
H2H 23G 25G B8 WA

(56) Documents cited

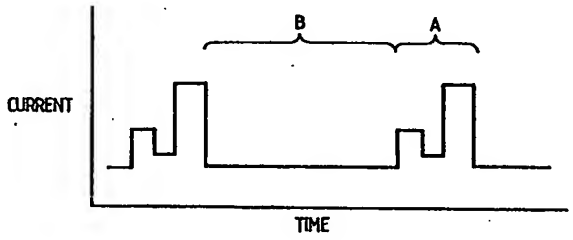
GB A 2057325		GB	1164005
GB	1561003	GB	1106687
GB	1403995	US	3944780
GB	1215892	US	3781511
GB	1188027	US	3683149
GB	1165201	WO A1	81/00799

(58) Field of search
H2H
Selected US specifications from IPC sub-class B23K

(54) Welding power supply

(57) Current supplied to a welding electrode has a waveform of cyclic form, each cycle comprising a pulse portion A and a relatively low level portion B, the pulse portion being of varying amplitude to provide graded energy dissipation for the successive dissolution of constituents of the welding electrode, so that, for welding wire with a flux core, the metal and flux core detach substantially simultaneously. Each pulse portion A may comprise a plurality of closely spaced rectangular pulses, such as a pulse of relatively small amplitude followed by a pulse of relatively large amplitude. Alternatively, each pulse portion A may effectively have a single pulse with graded amplitude.

Fig.2.



GB 2 171 267 A

Fig.1.

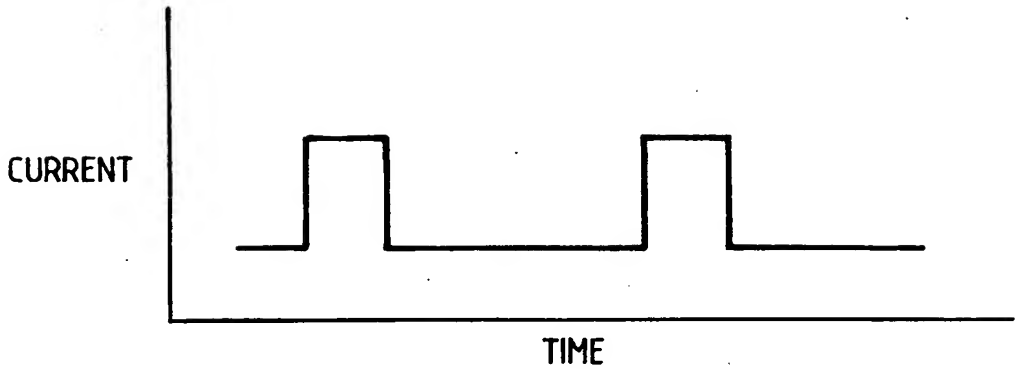
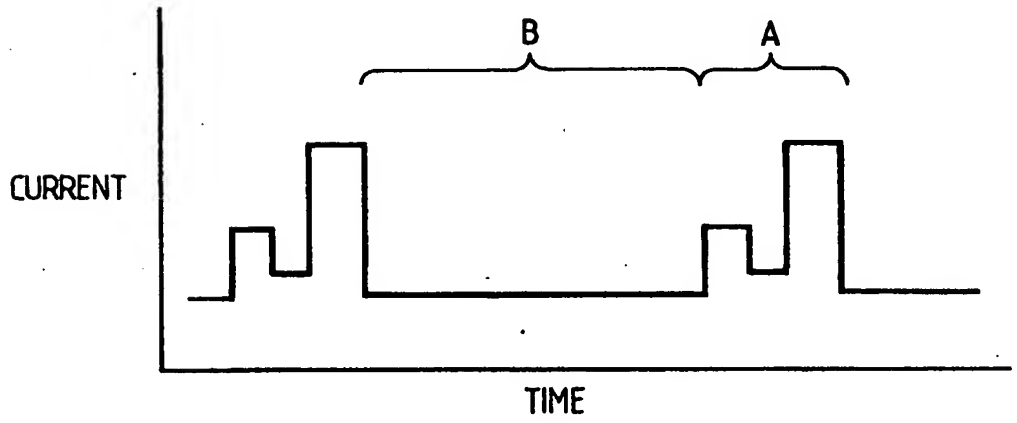


Fig.2.



SPECIFICATION

Welding Power Supply

This invention relates to power supplies for welding processes. Pulsed current supplies for welding purposes are well known and are quite successful in transferring metal from a wire electrode to a workpiece. In metal-inert-gas (MIG) welding, for example, this pulsed supply system is used to transfer one drop of metal per current pulse. A difficulty arises however, where the wire electrode is flux cored, since the metal sheath and the flux core tend to detach separately.

It is an object of the present invention to overcome this difficulty and cause the metal and flux core to detach substantially simultaneously.

According to the present invention a welding power supply is adapted to supply current to a welding electrode, the current having a waveform of cyclic form, each cycle comprising a pulse portion and a relatively low level portion, the pulse portion being a varying amplitude to provide graded energy dissipation for the successive dissolution of constituents of the welding electrode.

The pulse portion may comprise a plurality of closely spaced rectangular pulses, and in particular may comprise a pulse of relatively small amplitude followed by a pulse of relatively large amplitude.

A welding power supply in accordance with the invention will now be described by way of example, with reference to the accompanying drawings, of which:

Figure 1 is a current waveform of a conventional welding power supply,

and Figure 2 is one example of a current waveform of a power supply according to the invention.

In automated MIG welding processes the feed metal is supplied by the welding electrode which is commonly a wire of perhaps 2 millimetres diameter fed continuously at a fairly high speed, typically 5 meters per minute. Where the welding wire is plain metal, i.e. with no flux core or sheath, a current supply having the waveform of Figure 1 is satisfactory. In this waveform there is a single pulse periodically at typically 10 millisecond intervals the pulse amplitude being typically 400 amps from a D.C.'background' level of typically 100 amps . Such a current supply is satisfactory in this case for producing one molten drop of electrode wire metal for each pulse of the current waveform.

It may be noted that in this prior art current waveform there are four controllable parameters: pulse amplitude; pulse width; pulse repetition rate; and background level. These can each be controlled in conjunction with the welding wire feed rate to achieve the desired welding conditions.

Where welding wire with a flux core is used, the metal sheath tends to detach before the flux core so upsetting the proper balance between flux and metal at the weld. The solution according to the invention is to grade the current pulse and thus the energy dissipation, to provide controlled dissolution of the composite welding wire. Referring to Figure 2 this shows a cyclic current waveform having a pulse portion A and a relatively low level portion B in each period. The pulse portion comprises two rectangular pulses in close succession, the first pulse, 1, having an amplitude of typically 300 amps and the second, 2, of typically 600 amps. The pulses each have a duration of typically a few milliseconds and are spaced by a similar period. The background current level, i.e. in the low level portion B of the cycle, may be up to typically 100 amps. A cycle repetition rate between about 50 and 300 Hz is practical.

Between the pulses 1 and 2 the level may be the background level in the portion B or may differ from this value. There are thus eight parameters of the waveform that can be controlled - amplitude and width of each pulse; spacing between the pulses 1 & 2, background current level, current level between the pulses, and cycle repetition rate. All of these parameters can be controlled individually to achieve a satisfactory welding process in the particular circumstances.

The power supply circuit is a solid state circuit employing high power thyristors or transistors. The continuously fed cored welding wire constitutes one electrode, from which an arc is struck to the workpiece, constituting the other.

The flex may be provided as a core to the welding wire or as a sheath. Since the overall wire diameter may be relatively small and a coil of the wire is required, a cored version may be more practicable.

The amplitude of the current pulses determines the rate of energy dissipation and accordingly, by adjusting the two pulse amplitudes suitably, the more easily detached metal is removed by the first, smaller, pulse and the flux or metal powder core by the immediately following larger pulse.

It will be appreciated that the grading of the pulse portion of the waveform may be achieved by a modified version of the simple double-pulse current.

The inter-pulse level can be adjusted so as to provide in effect three contiguous pulses of different amplitudes. Again, the three levels can be adjusted to provide, in effect, a single pulse with graded amplitude. A development of such a pulse would be a single pulse with analogue amplitude variation according to some predetermined characteristic.

CLAIMS

1. A welding power supply adapted to supply current to a welding electrode, the current having a waveform of cyclic form, each cycle comprising a pulse portion and a relatively low level portion, the pulse portion being of varying amplitude to provide graded energy dissipation for the successive dissolution of constituents of the welding electrode.

2. A power supply according to Claim 1, wherein said pulse portion comprises a plurality of closely spaced rectangular pulses.

3. A portion supply according to Claim 2, wherein said pulse portion comprises a pulse of relatively small amplitude followed by a pulse of relatively large amplitude.

4. A power supply substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

Printed in the UK for HMSO, D8818935, 6/86, 7102.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.